

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 88101320.5

(51) Int. Cl.⁴ **H01L 23/52, H01L 25/04,
H01L 21/60**

(22) Date of filing: 29.01.88

(30) Priority: 02.02.87 US 9981

(43) Date of publication of application:
10.08.88 Bulletin 88/32

(84) Designated Contracting States:
DE FR GB IT

(71) Applicant: **International Business Machines Corporation**
Old Orchard Road
Armonk, N.Y. 10504(US)

(72) Inventor: **Gazdik, Charles Edward**
911 Westminster Road
Endicott, N.Y. 13760(US)
Inventor: **McBride, Donald Gene**
2058 Cheshire Road
Binghamton, N.Y. 13903(US)
Inventor: **Seraphim, Donald Phillip**
400 Rano Blvd.
Vestal, N.Y. 13850(US)
Inventor: **Toole, Patrick Albert**
20 Harborview Rd.
Westport, CT 06880(US)

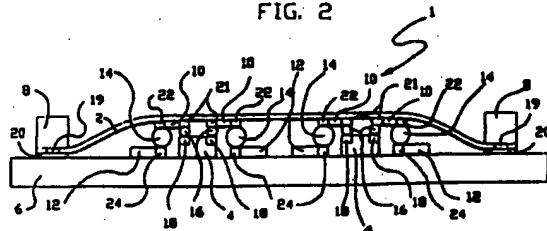
(74) Representative: **Teufel, Fritz, Dipl.-Phys. et al**
IBM Deutschland GmbH Europäische
Patentdienste Postfach 22 00 26
D-8000 München 22(DE)

(54) Full panel electronic packaging structure and method of making same.

(57) An electronic packaging structure (1), and a method of making this structure, are disclosed. The electronic packaging structure comprises a full panel, circuitized flexible film semiconductor chip carrier (2) mounted on a circuitized substrate (6) such as a printed circuit board. A plurality of semiconductor chips (4) are mounted on the carrier in a selected pattern, and the carrier, with the chips, is mounted on a matching pattern of bonding sites on the circuitized substrate. Preferably, the circuitized flexible film semiconductor chip carrier is manufactured on a support structure used to facilitate handling of the circuitized flexible film and to facilitate heat transfer from the semiconductor chips mounted on the carrier to a heat sink (20) which is part of the circuitized substrate. Also, the semiconductor chips mounted on the flexible film chip carrier may be tested, and

burned in, while on the support structure before the chip carrier, with the chips, is mounted on the circuitized substrate.

FIG. 2



EP 0 277 606 A2

FULL PANEL ELECTRONIC PACKAGING STRUCTURE AND METHOD OF MAKING SAME

BACKGROUND OF THE INVENTION

The present invention relates to electronic packaging, and, more particularly, relates to structures for electronic packaging of semiconductor chips, and to methods for making such electronic packaging structures.

Typically, semiconductor chips are mounted on circuitized substrates, known as semiconductor chip carriers, having electrical circuit lines for connecting the chip to a printed circuit board, or other such electronic structure, which may be used as part of a computer, or other such equipment. For example, in many applications, it is desirable to mount several semiconductor chip carriers, each housing at least one semiconductor chip, on one printed circuit board. Typically, the several semiconductor chip carriers, with their semiconductor chips, are interconnected electrically by the circuitry of the printed circuit board.

In a relatively high volume manufacturing environment, there is a need to reliably and cost-effectively manufacture such printed circuit boards, and other such structures, with a plurality of semiconductor chips mounted thereon. These manufacturing goals become increasingly more difficult to reach as the number and complexity of the semiconductor chips which it is desired to mount on one printed circuit board, or other such structure, increases.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide an electronic packaging structure for reliably and cost-effectively mounting a plurality of electronic devices on a printed circuit board or other such structure.

Another object of the present invention is to provide a method for making such an electronic packaging structure which is suitable for use in a relatively high volume manufacturing environment.

These and other objects of the present invention are attained by an electronic packaging structure comprising a full panel flexible film chip carrier having a plurality of semiconductor chips, or other such electronic devices, mounted thereon in a selected pattern. This full panel flexible film chip carrier is mounted on a circuitized substrate, such as a printed circuit board, having a plurality of bonding sites, electrically interconnected by the circuit lines of the substrate, and arranged in a pattern which matches the pattern of the semicon-

ductor chips mounted on the full panel flexible film chip carrier. Preferably, the full panel flexible film chip carrier is an integral, flexible sheet of polyimide sized to cover all of the bonding sites on the circuitized substrate, and having circuitry on at least one side with lands for interconnecting the circuitry of the polyimide layer to the bonding sites on the circuitized substrate.

The foregoing electronic packaging structure is especially suited for manufacture in a relatively high volume manufacturing environment by a method which comprises mounting a full panel circuitized flexible film, with a plurality of electronic devices mounted thereon in a selected pattern, to a circuitized substrate having a plurality of bonding sites, electrically interconnected with circuit lines, and arranged in a pattern which matches the pattern of the electronic devices on the circuitized flexible film. Preferably, the circuitized flexible film is formed on a support structure which may be used to facilitate handling of the circuitized flexible film before it is mounted on the circuitized substrate, and which may be used to facilitate heat transfer from the electronic devices mounted on the circuitized flexible film to a heat sink which is part of the circuitized substrate. Also, preferably, the electronic devices mounted on the circuitized flexible film are tested and burned in while on the support structure before the circuitized flexible film is mounted on the circuitized substrate.

BRIEF DESCRIPTION OF THE DRAWING

Other objects and advantages of the present invention will be apparent from the following description in conjunction with the accompanying drawing, in which like reference numerals identify like elements, and in which:

Figure 1 is a perspective view of an electronic packaging structure in accordance with the principles of the subject invention, comprising a full panel circuitized flexible film with a plurality of semiconductor chips mounted on a printed circuit board.

Figure 2 is a cross-sectional view taken along line A-A of the electronic packaging structure shown in Figure 1.

Figure 3 is a perspective view of the full panel circuitized flexible film with the plurality of semiconductor chips shown in Figure 1.

Figure 4 is a perspective view of the printed circuit board shown in Figure 1.

possible to match the semiconductor chips 4 on the circuitized flexible film 2 with a circuit board 6 which does not need to use the chip site(s) found to be defective.

Also, the packaging structure 1 and method for making such a structure 1 according to the present invention, provide for handling many semiconductor chips 4, or other such electronic devices, at once. That is, several semiconductor chips 4 may be handled at the same time on one full panel, circuitized flexible film 2. This feature of the present invention is very important since it can increase productivity, reduce manufacturing costs, and, in general, make it easier to manufacture electronic equipment, such as computers, especially when it is desired to manufacture such equipment in a relatively high volume manufacturing environment. For example, when handling a full panel of semiconductor chips 4 which are to be mounted on a circuit board 6, the entire panel of the semiconductor chips 4 may be aligned, and placed in registration, with the circuit board 6, in one operation. This eliminates the need to individually align, and place in registration, each of the semiconductor chips 4 with respect to its matching bonding site 25 on the circuit board 6, which otherwise would be necessary if a single chip handling type manufacturing technique was used.

Claims

1. An electronic packaging structure (1) comprising:

a circuitized substrate (6) having a plurality of bonding sites arranged in a selected pattern on said circuitized substrate; and

a flexible film chip carrier (2) with circuitry connected to a plurality of electronic devices (4) mounted on said carrier in a pattern which matches the selected pattern of bonding sites on the circuitized substrate, said flexible film chip carrier mounted on the circuitized substrate with said electronic devices interconnected through said circuitry of said chip carrier to the the circuitry at the bonding sites of the circuitized substrate.

2. An electronic packaging structure as recited in claim 1 wherein said circuitized substrate comprises a printed circuit board (6) and/or

wherein each of said electronic devices comprises an integrated circuit chip (4).

3. An electronic packaging structure as recited in claim 1 or 2 wherein said flexible film chip carrier comprises:

a flexible layer (2) of polyimide with circuitry on at least one side of said polyimide layer, said circuitry including pads (21) on which the integrated circuit chips are mounted and lands interconnecting said circuitry on said polyimide layer to the circuitry on the circuitized substrate.

4. An electronic packaging structure as recited in claim 3 wherein said flexible layer of polyimide comprises a sheet of polyimide having a thickness between approximately 5.1 microns (about 0.0002 inch) and 7.6 microns (about 0.0003 inch).

5. An electronic packaging structure as recited in one of the claims 1 - 4 wherein said circuitized substrate includes at least one heat sink (20).

6. An electronic packaging structure as recited in claim 5 wherein said flexible film chip carrier includes a thermally conductive frame (8) in thermal contact with the heat sink of the circuitized substrate.

7. A method for making an electronic packaging structure comprising the steps of:

fabricating a substrate (6) with circuitry having a plurality of bonding sites arranged in a selected pattern;

forming a layer (2) of flexible film on a support structure, said flexible film being sized and configured to cover the bonding sites of the circuitized substrate when said flexible film is mounted on the circuitized substrate;

circuitizing the flexible film on the support structure with a circuit pattern having a plurality of device attachment sites matching the selected pattern of bonding sites on the circuitized substrate;

attaching a selected electronic device (4) to each of the device attachment sites of the circuitry on the flexible film; and

mounting the circuitized, flexible film, with the electronic devices attached thereto, on the circuitized substrate whereby each of the electronic devices attached to the circuitized, flexible film, is interconnected through the circuitry on the flexible film to the circuitry at the matching bonding site on the circuitized substrate.

8. A method for making an electronic packaging structure as recited in claim 7 further comprising the step of:

testing each of the electronic devices attached to the circuitized, flexible film before this film is mounted on the circuitized substrate.

9. A method for making an electronic packaging structure as recited in claim 8 wherein the step of mounting the circuitized, flexible film, with

the electronic devices attached thereto, on the circuitized substrate comprises:

mounting the circuitized, flexible film with the electronic devices on a circuitized substrate having functional bonding sites matching only the electronic devices found to be functional after testing.

10. A method for making an electronic packaging structure as recited in claim 8 or 9 comprising the step of:

burning in each of the electronic devices attached to the circuitized, flexible film before this film is mounted on the circuitized substrate.

11. A method for making an electronic packaging structure as recited in one of the claims 7 - 10 further comprising the step of:

removing the support frame from the circuitized, flexible film after this film, with the electronic devices attached thereto, has been mounted on the circuitized substrate.

12. A method for making an electronic packaging structure as recited in one of the claims 7 - 11 wherein the step of attaching a selected electronic device to the circuitry on the flexible film comprises:

joining the electronic device to pads using a controlled collapse chip connection (C-4) technique.

13. A method for making an electronic packaging structure as recited in one of the claims 7 - 12 wherein the flexible film comprises a sheet of polyimide and the step of depositing metal comprises depositing successive layers of chromium, copper, and chromium on said sheet of polyimide.

5

10

15

20

25

30

35

40

45

50

55

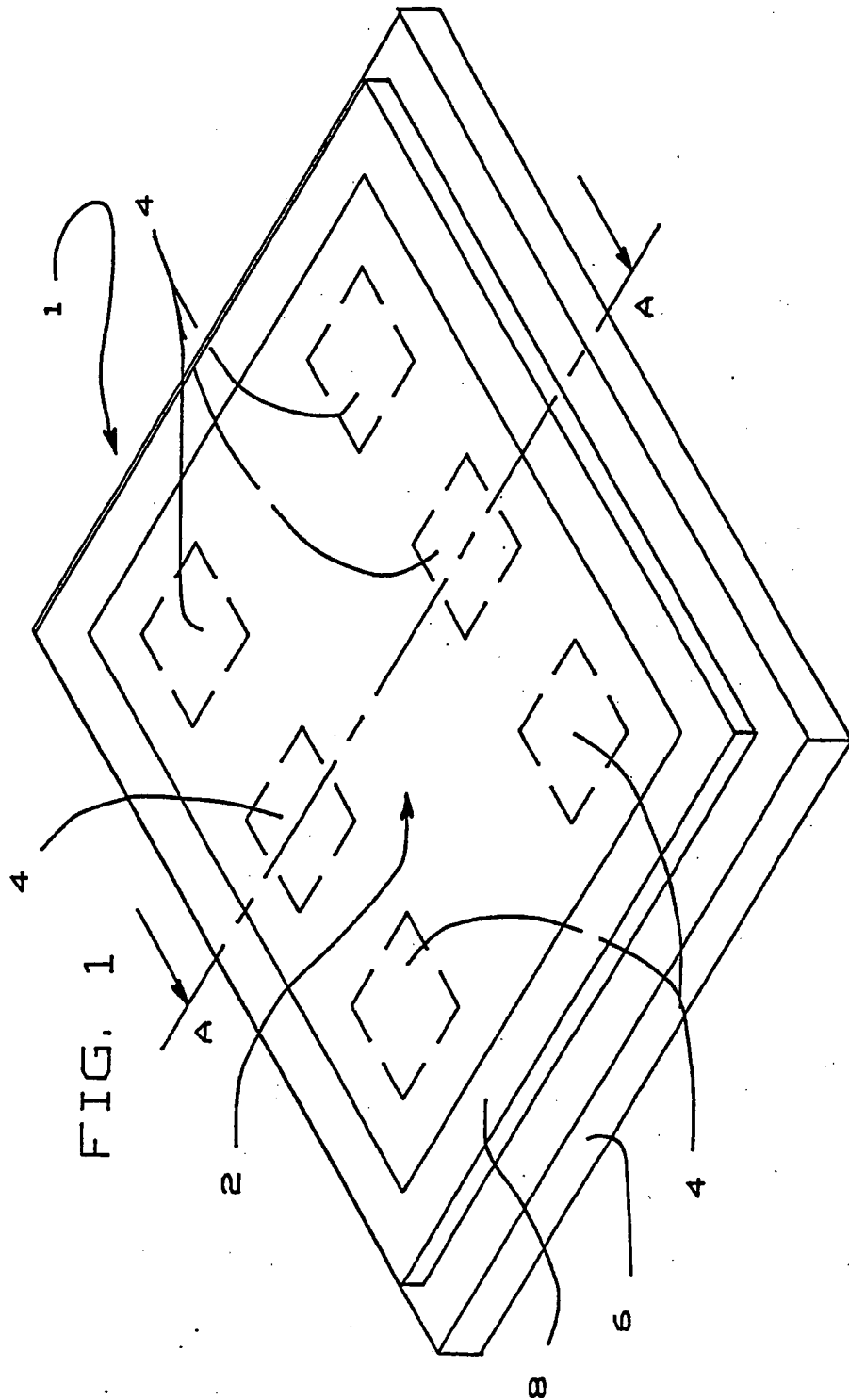


FIG. 2

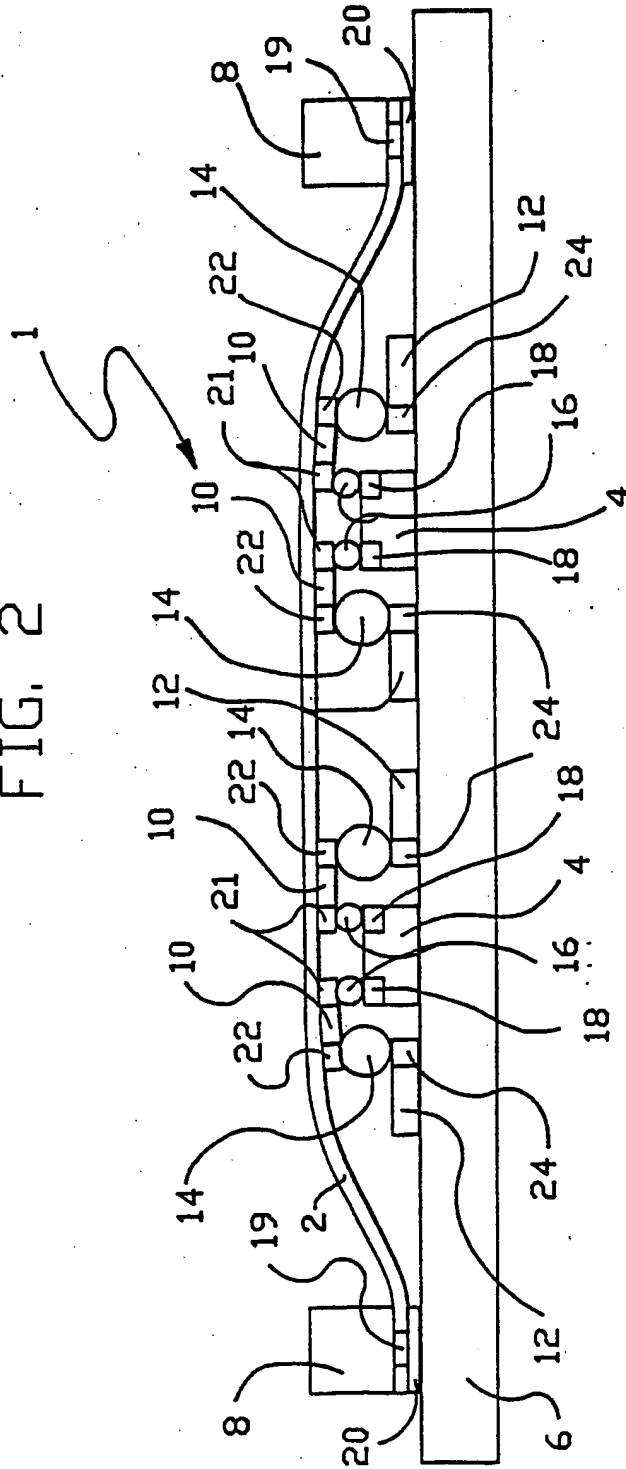


FIG. 4

